The observation of heavy flavor production at $\sqrt{s_{NN}}$= 200 GeV in both p+p and Au+Au collisions by the PHENIX Experiment at RHIC provides for complimentary physics exploration in differing collision environments. The measurement of single leptons resulting from the semi-leptonic decay of heavy flavor (charm and bottom) mesons in p+p collisions permits tests of pQCD predictions at $\sqrt{s}$= 200 GeV, as well as a statement of a total charm cross section. The measurements in p+p collisions also provide a key baseline against which the analogous single lepton measurements in Au+Au can be quantified. The dense partonic matter produced in Au+Au collisions can be interpreted through the simultaneously observation of azimuthal anisotropy $v_2(p_{rmT})$ and the nuclear modification factor $\mathrm{R}_{AA}(p_{rmT})$. In the context of existing predictions, the observed flow and energy loss of heavy quarks, in addition to that already seen for light mesons, suggests that the matter formed in Au+Au collisions at RHIC is a near-perfect fluid. The most recent PHENIX single electron results from p+p and Au+Au collisions for $0.3 < p_{rmT} < 9.0$ GeV/c at $\mid y \mid < 0.35$ are shown. The first PHENIX heavy flavor single muon measurement at $1.5 < \mid y \mid < 1.8$ in $\sqrt{s}$= 200 GeV p+p is also presented.